

# PATENT SPECIFICATION

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F2B 13C2A 13C2B 13C2E3A 13C2E4 13D 13G 13X2



## (54) IMPROVEMENTS IN OR RELATING TO SHIP'S PROPELLER SHAFT SEALS

(71) I, JAN KUIKEN, a British subject, of The Lodge, I, Orchard Close, South Winstan, Winchester, Hampshire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to seals for rotary shafts and in particular to seals for ships for providing liquid-tight sealing where a ships propeller shaft protrudes outboard from a bearing in an aperture in a ship's hull in which bearing the shaft is rotatably

assembly for a ship in combination with a rotatable radial face type seal arrangement the said arrangement comprising a stationary seal element having at least two concentric rings with radially extending seal faces the said element being adapted to be connected to the ship's structure where the propeller shaft protrudes in a sealing and non-rotatable relationship to the ship's structure, the said seal faces being radially separated from each other by an annular channel for the purpose of arresting outboard water or bearing lubricant that may otherwise move across the seal faces in an inboard or outboard

### ERRATUM

SPECIFICATION NO 1522739

Page 2, line 125, Page 2, line 126, Page 2, line 127, delete whole lines

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30 January 1979

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30 as sand and silt to seal faces and the development of marine growth affecting the capacity of a seal to absorb axial and radial movements of the shaft and the propeller in relation to the hull structure.

35 As regards providing for resilience in a seal for absorbing the above movements the design possibilities are restricted by the usually limited space that can be made available for accommodating the seal.

40 It is an object of this invention to provide a propeller shaft seal in which the above problems are minimised to a large extent.

45 The present invention consists in a propeller, a propeller shaft and bearing

The said pressure may be provided by means of a compression ring around the cushion ring the said compression ring being secured to the propeller hub with provision for free expansion for the cushion ring by an arrangement of void spaces.

The said void spaces may be vented to the annular channel in order to prevent the void spaces from becoming blocked by accumulation of liquids.

The degree of resilience provided by means of the said cushion ring may be increased by having in combination with the cushion ring spring loading.

The rotatable seal element may be arranged to allow the rotatable seal faces to

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## (54) IMPROVEMENTS IN OR RELATING TO SHIP'S PROPELLER SHAFT SEALS

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The present invention relates to seals for rotary shafts and in particular to seals for ships for providing liquid-tight sealing where a ship's propeller shaft protrudes outboard from a bearing in an aperture in a ship's hull in which bearing the shaft is rotatably supported and where the purpose of the seal is preventing outboard water from entering the bearing and to prevent bearing lubricant from escaping to outboard.

A problem with such seals is the difficulty in achieving the said purpose to perfection. Even with the bearing lubricant having a higher pressure than that of the outboard water the latter liquid is known to move across the seal into the bearing with likely detrimental effects on the machinery and vice versa lubricant leaks in opposite direction and is lost to outboard.

Other problems are the damaging effects from outboard water carrying solids such as sand and silt to seal faces and the development of marine growth affecting the capacity of a seal to absorb axial and radial movements of the shaft and the propeller in relation to the hull structure.

As regards providing for resilience in a seal for absorbing the above movements the design possibilities are restricted by the usually limited space that can be made available for accommodating the seal.

It is an object of this invention to provide a propeller shaft seal in which the above problems are minimised to a large extent.

The present invention consists in a propeller, a propeller shaft and bearing

assembly for a ship in combination with a rotatable radial face type seal arrangement the said arrangement comprising a stationary seal element having at least two concentric rings with radially extending seal faces the said element being adapted to be connected to the ship's structure where the propeller shaft protrudes in a sealing and non-rotatable relationship to the ship's structure, the said seal faces being radially separated from each other by an annular channel for the purpose of arresting outboard water or bearing lubricant that may otherwise move across the seal faces in an inboard or outboard direction respectively, the said channel being provided with drainage facilities and flexibly connected to the propeller shaft and propeller assembly and in a sealing and non-rotatable relationship therewith at least one rotatable seal element with radial seal faces in sliding sealing contact with the said stationary seal faces.

The said flexible connection is provided by interposing one or more cushion rings made of a resilient material such as rubber under pressure between the propeller hub and the said rotatable seal element and in a sealing and non-rotatable relationship thereto.

The said pressure may be provided by means of a compression ring around the cushion ring the said compression ring being secured to the propeller hub with provision for free expansion for the cushion ring by an arrangement of void spaces.

The said void spaces may be vented to the annular channel in order to prevent the void spaces from becoming blocked by accumulation of liquids.

The degree of resilience provided by means of the said cushion ring may be increased by having in combination with the cushion ring spring loading.

The rotatable seal element may be arranged to allow the rotatable seal faces to

follow independently of each other axial displacements as may result from unequal wear on the seal faces.

The seal faces adjacent to the outboard water may be provided with a special lubrication connection in order that these faces do not wear at a faster rate than the seal faces adjacent to the stern bearing lubricant.

The cushion ring may be radially split and similar arrangements may be made for the seal faces in order that these parts may be replaced without having to remove the propeller from the shaft.

A clean water supply from the ship's services may be connected to the space surrounding the seal arrangement to ensure that the seal may at all times operate in sand- and silt-free water.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 shows an axial section of a ship's outboard propeller shaft seal arrangement according to the present invention.

Figure 2 shows the seal arrangement of Figure 1 but with the spring loading added and a modification which allows seal faces to move axially independently of each other, according to the present invention.

Referring to Figure 1, the drawing shows part of the propeller shaft 1 with an axial section of part of the propeller hub 2, a sectional elevation of part of the hull structure 3 with in cross section part of the shaft bearing 4.

Secured fluid tight to the shaft bearing closing plate 5 is the stationary seal element consisting of a base ring 6 with concentric grooves in which are accommodated the seal face rings 7 and 8 which may be radially split, the seal faces on rings 7 and 8 being separated by the annular space 9 with drain connection 10 leading into the ship.

The seal face on ring 8 is provided with a lubricating connection 11.

The rotatable seal element consists of a base ring 12 provided with a groove in which is accommodated a seal face ring 13 which is in a sliding sealing contact with the seal faces on rings 7 and 8.

Ring 13 may be radially split.

The cushion ring 14 which may be of rubber and which by means of interlocking surfaces keeps the rotatable seal element radially positioned and transmits flexibly the rotational movement of the propeller and of the propeller shaft to the element has access to void spaces, vent tubes 15, 16 and 17 communicating these void spaces with the drainage connection 10 so as to prevent the void spaces from becoming blocked by accumulation of liquids, the void spaces being 23, 24 and 25.

The cushion ring 14 is radially compressed

between a radially split compression ring 18 and a ring 19, both of which are secured fluid tight to the propeller hub.

Ring 19 is also the compression ring for the usually fitted rubber sealing ring 20 for the purpose of preventing oil or water entering between the propeller hub and the shaft.

The pipe connection 21 provides a clean water supply to the space adjacent the seal arrangement within the confinement of the rope guard 22.

Referring to Figure 2, the drawing shows the addition of spring loading, the modification that provides allowance for independent axial movement of seal faces and there is also indicated an enlargement of the capacity of the void spaces.

Parts having essentially the same functions as those in the arrangement of Figure 1 are provided with the same reference numerals in Figure 2 but the latter have one apostrophe.

The resilience provided by the cushion ring 14' is augmented by a plurality of coil springs 26, spaced around the radially inner side of the cushion ring 14'; each spring is encased in a flanged cap 27, each cap being embedded in the cushion ring the flanges of the said caps transmitting the spring pressure to the ring 14'.

The capacities of the void spaces 24 and 25 are enlarged to allow for increased axial displacements of the propeller shaft in relation to the ship's structure.

Instead of the single base ring 12 in Figure 1, the Figure 2 shows two independent rings 28 and 29 each with its own seal face ring, 30 and 31.

Seal face rings 30 and 31 may be radially split.

The drainage connections 10 and 10' on the two drawings would lend themselves for flushing the seal arrangement from inside the ship.

#### WHAT I CLAIM IS:—

1. A propeller, a propeller shaft and bearing assembly for a ship in combination with a rotatable radial face type seal arrangement the said arrangement comprising, a stationary seal element having at least two concentric rings with radially extending seal faces the said element being adapted to be connected to the ship's structure where the propeller shaft protrudes, in a sealing and non-rotatable relationship to the ship's structure, the said seal faces being radially separated from each other by an annular channel for the purpose of arresting outboard water or the said seal faces being radially separated from each other by an annular channel for the purpose of arresting outboard water or bearing lubricant that may otherwise move across the seal faces in an inboard or outboard direction respectively, the said channel

being provided with drainage facilities, and flexibly connected to the propeller shaft and propeller assembly and in a sealing and non-rotatable relationship therewith at least one  
5 rotatable seal element with radial seal faces in sliding sealing contact with the said stationary seal faces.

2. A combination according to claim 1, wherein the stationary or the rotatable seal  
10 faces are allowed axial movement in relation to each other in order to be able to maintain sliding sealing contact under un-equal seal face wear conditions.

3. A combination according to claims 1  
15 or 2, wherein the rotatable seal element is flexibly connected to the propeller and shaft assembly in a sealing and non-rotatable relationship thereto by means of at least one cushion ring made of a resilient material  
20 such as rubber, the said cushion ring being under pressure thereby exerting an axial thrust that keeps the rotatable and the non-rotatable seal faces pressed together in a sliding sealing contact.

25 4. A combination according to claim 3, wherein the said cushion ring is placed under pressure by means of a surrounding compression ring.

30 5. A combination according to claims 3 or 4, wherein there are void spaces which provide free expansion for the said cushion

ring.

6. A combination according to claim 5, wherein the void spaces are provided with vent connections for preventing the said void  
35 spaces from becoming blocked by accumulation of liquids.

7. A combination according to any one of claims 3 to 6, wherein the said cushion  
40 ring is operating in combination with a plurality of springs which are embedded in the cushion ring and exert an axial pressure in concert with the cushion ring.

8. A combination according to any one of claims 3 to 7, wherein the cushion ring and  
45 the seal faces are radially split to allow for replacement of the cushion ring and the seal faces without having to remove the propeller from the shaft.

9. A combination according to any one  
50 of the preceding claims, wherein seal faces are provided with lubricating connections.

10. A combination according to any one of the preceding claims, wherein there is  
55 a clean water supply connection for purging the water space around the seal arrangement.

11. A rotatable radial face type seal  
60 arrangement constructed and arranged substantially as described herein and as shown in the accompanying drawings.

J. KUIKEN.

FIG. 1.

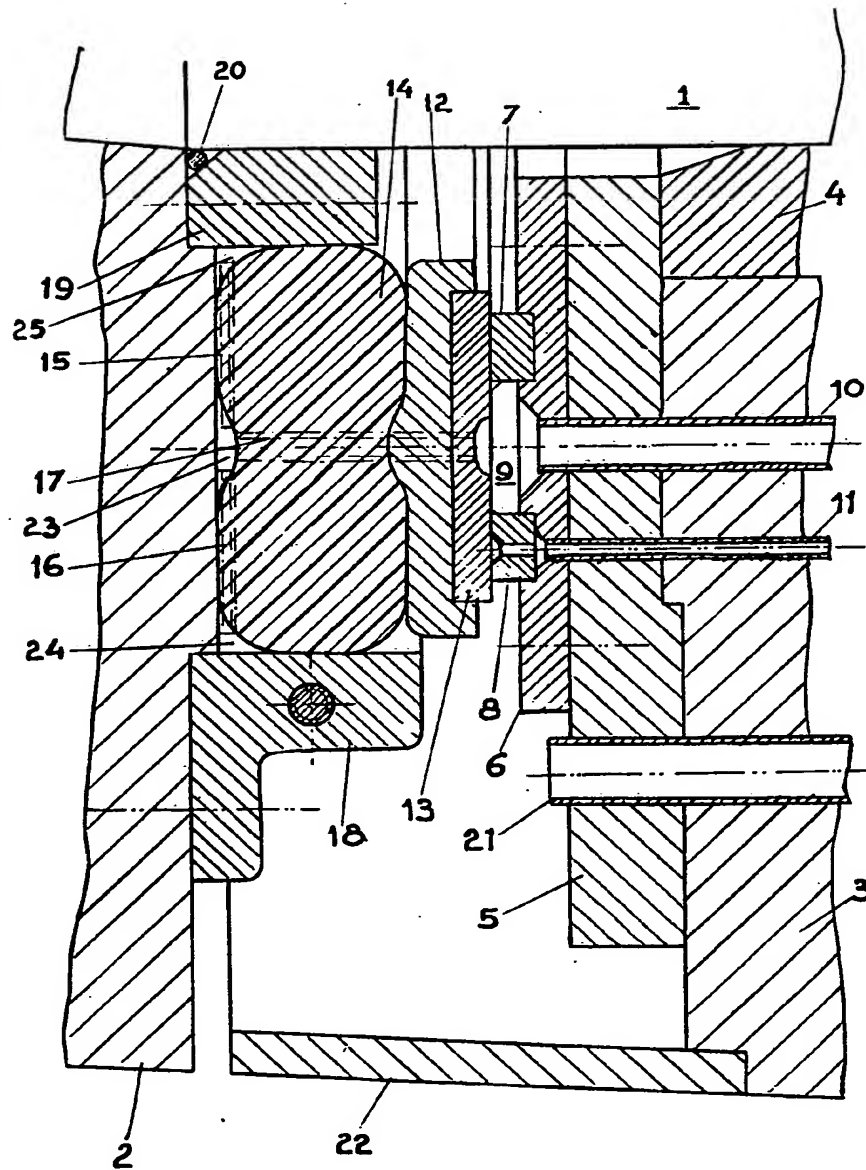
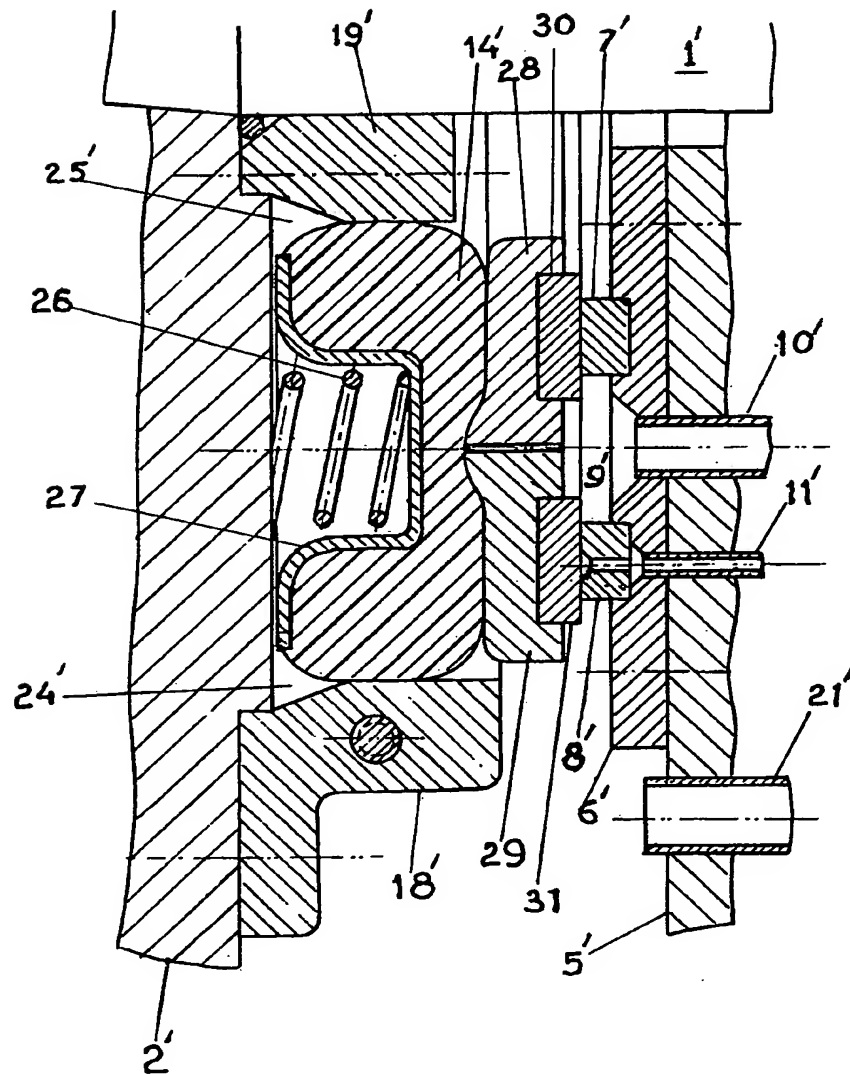


FIG. 2.



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